SPARQL By Example: The Cheat Sheet

Accompanies slides at:

http://www.cambridgesemantics.com/semantic-university/sparql-by-example

Comments & questions to:

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Conventions

Red text means:

“This is a core part of the SPARQL syntax or language.”

Blue text means:

“This is an example of query-specific text or values that might go into a SPARQL query.”

Nuts & Bolts

URIs

Write full URIs:

```
<http://this.is.a/full/URI/written#out>
```

Abbreviate URIs with prefixes:

```
PREFIX foo: <http://this.is.a/URI/prefix#>
… foo:bar …
      ⇒   http://this.is.a/URI/prefix#bar
```

Shortcuts:

```
a   ⇒   rdf:type
```

Literals

Plain literals:

```
"a plain literal"
```

Plain literal with language tag:

```
"bonjour"@fr
```

Typed literal:

```
"13"^^xsd:integer
```

Shortcuts:

```
true  ⇒  "true"^^xsd:boolean
3     ⇒     "3"^^xsd:integer
4.2   ⇒   "4.2"^^xsd:decimal
```

Variables

Variables:

```
?var1, ?anotherVar, ?and_one_more
```

Comments

Comments:

```
# Comments start with a '#' and
# continue to the end of the line
```

Triple Patterns

Match an exact RDF triple:

```
ex:myWidget ex:partNumber "XY24Z1" .
```

Match one variable:

```
?person foaf:name "Lee Feigenbaum" .
```

Match multiple variables:

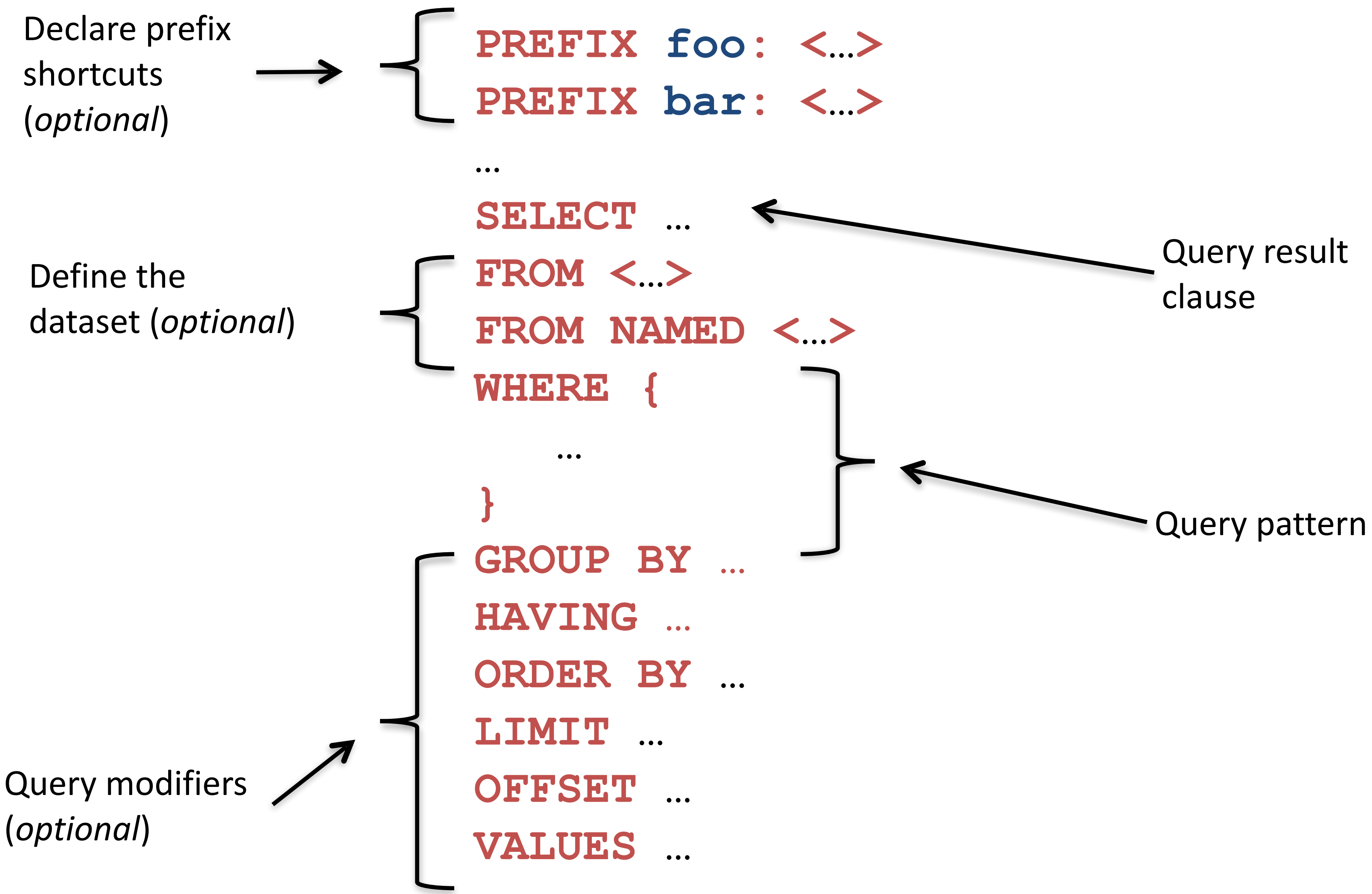
```
conf:SemTech2009 ?property ?value .
```

Common Prefixes

prefix...	...stands for
rdf:	***http://xmlns.com/foaf/0.1/***
rdfs:	http://www.w3.org/2000/01/rdf-schema#
owl:	***http://www.w3.org/2002/07/owl#***
xsd:	http://www.w3.org/2001/XMLSchema#
dc:	***http://purl.org/dc/elements/1.1/***
foaf:	http://xmlns.com/foaf/0.1/

More common prefixes at http://prefix.cc

Anatomy of a Query



```
PREFIX foo: <…>
PREFIX bar: <…>
…
SELECT …
FROM <…>
FROM NAMED <…>
WHERE {
      …
}
GROUP BY …
HAVING …
ORDER BY …
LIMIT …
OFFSET …
VALUES …
```

Declare prefix shortcuts (*optional*)
Query result clause
Define the dataset (*optional*)
Query pattern
Query modifiers (*optional*)

4 Types of SPARQL Queries

SELECT queries

Project out specific variables and expressions:

```
SELECT ?c ?cap (1000 * ?people AS ?pop)
```

Project out all variables:

```
SELECT *
```

Project out distinct combinations only:

```
SELECT DISTINCT ?country
```

Results in a table of values (in XML or JSON):

?c	?cap	?pop
ex:France	*ex:Paris*	*63,500,000*
ex:Canada	*ex:Ottawa*	*32,900,000*
ex:Italy	*ex:Rome*	*58,900,000*

CONSTRUCT queries

Construct RDF triples/graphs:

```
CONSTRUCT {
   ?country a ex:HolidayDestination ;
       ex:arrive_at ?capital ;
       ex:population ?population .
}
```

Results in RDF triples (in any RDF serialization):

```
ex:France a ex:HolidayDestination ;
    ex:arrive_at ex:Paris ;
    ex:population 635000000 .
ex:Canada a ex:HolidayDestination ;
    ex:arrive_at ex:Ottawa ;
    ex:population 329000000 .
```

ASK queries

Ask whether or not there are any matches:

```
ASK
```

Result is either "true" or "false" (in XML or JSON):

```
true, false
```

DESCRIBE queries

Describe the resources matched by the given variables:

```
DESCRIBE ?country
```

Result is RDF triples (in any RDF serialization) :

```
ex:France a geo:Country ;
  ex:continent geo:Europe ;
  ex:flag <http://…/flag-france.png> ;
  …
```

Combining SPARQL Graph Patterns

*Consider **A** and **B** as graph patterns.*

A Basic Graph Pattern – one or more triple patterns

`A . B`

$\Longrightarrow$ Conjunction. Join together the results of solving A and B by matching the values of any variables in common.

Optional Graph Patterns

`A OPTIONAL { B }`

$\Longrightarrow$ Left join. Join together the results of solving A and B by matching the values of any variables in common, if possible. Keep all solutions from A whether or not there's a matching solution in B

Combining SPARQL Graph Patterns

*Consider **A** and **B** as graph patterns.*

Either-or Graph Patterns

```
{ A } UNION { B }
```

⟹ Disjunction. Include both the results of solving A and the results of solving B.

"Subtracted" Graph Patterns (SPARQL 1.1)

```
A MINUS { B }
```

⟹ Negation. Solve A. Solve B. Include only those results from solving A that are *not compatible* with any of the results from B.

SPARQL Subqueries *(SPARQL 1.1)*

*Consider **A** and **B** as graph patterns.*

```
A .
{
   SELECT …
   WHERE {
      B
   }
}
C .
```

⇒ Join the results of the subquery with the results of solving A and C.

SPARQL Filters

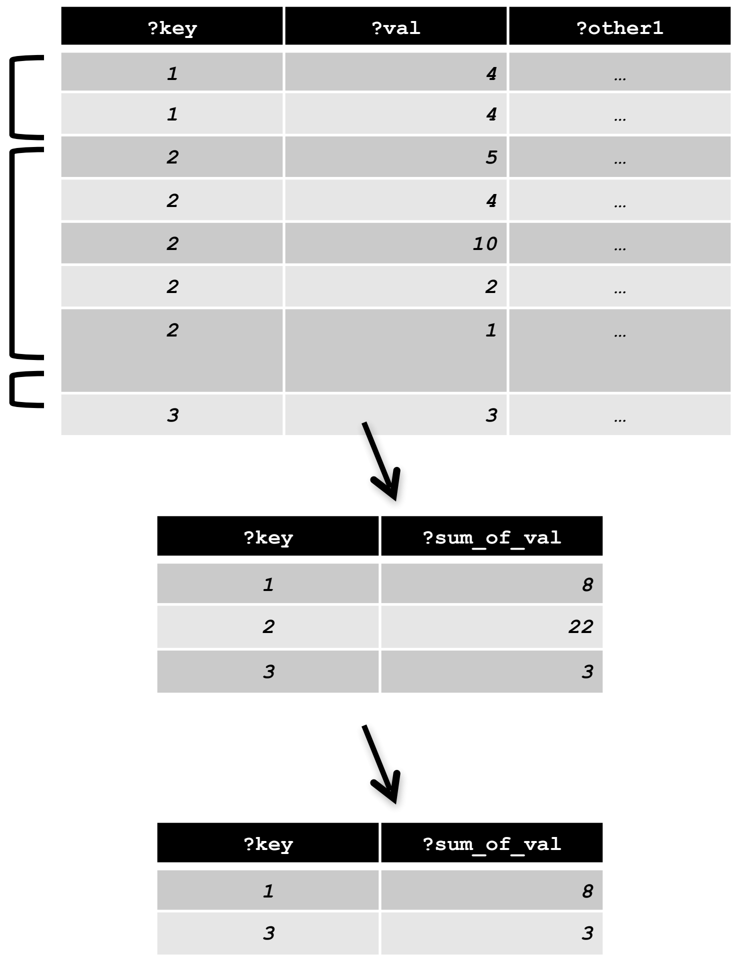
- *SPARQL* **`FILTER`***s eliminate solutions that do not cause an expression to evaluate to true.*
- *Place* **`FILTER`***s in a query inline within a basic graph pattern*

`A . B . FILTER (` *…expr…* **`)`**

Category	Functions / Operators	Examples
Logical & Comparisons	*!, &&, ||, =, !=, <, <=, >, >=, IN, NOT IN*	*?hasPermit || ?age < 25*
Conditionals *(SPARQL 1.1)*	*EXISTS, NOT EXISTS, IF, COALESCE*	*NOT EXISTS { ?p foaf:mbox ?email }*
Math	*+, -, *, /, abs, round, ceil, floor, RAND*	*?decimal * 10 > ?minPercent*
Strings *(SPARQL 1.1)*	*STRLEN, SUBSTR, UCASE, LCASE, STRSTARTS, CONCAT, STRENDS, CONTAINS,*	*STRLEN(?description) < 255*
Date/time *(SPARQL 1.1)*	*now, year, month, day, hours, minutes, seconds, timezone, tz*	*month(now()) < 4*
SPARQL tests	*isURI, isBlank, isLiteral, isNumeric, bound*	*isURI(?person) || !bound(?person)*
Constructors *(SPARQL 1.1)*	*URI, BNODE, STRDT, STRLANG, UUID, STRUUID*	*STRLANG(?text, “en”) = “hello”@en*
Accessors	*str, lang, datatype*	*lang(?title) = “en”*
Hashing *(1.1)*	*MD5, SHA1, SHA256, SHA512*	*BIND(SHA256(?email) AS ?hash)*
Miscellaneous	*sameTerm, langMatches, regex, REPLACE*	*regex(?ssn, "\\d{3}-\\d{2}-\\d{4}”)*

Aggregates *(SPARQL 1.1)*

1. Partition results into groups based on the expression(s) in the **GROUP BY** clause
2. Evaluate projections and aggregate functions in **SELECT** clause to get one result per group
3. Filter aggregated results via the **HAVING** clause



?key	?val	?other1
1	4	…
1	4	…
2	5	…
2	4	…
2	10	…
2	2	…
2	1	…
3	3	…

?key	?sum_of_val
1	8
2	22
3	3

?key	?sum_of_val
1	8
3	3

SPARQL 1.1 includes: **COUNT**, **SUM**, **AVG**, **MIN**, **MAX**, **SAMPLE**, **GROUP_CONCAT**

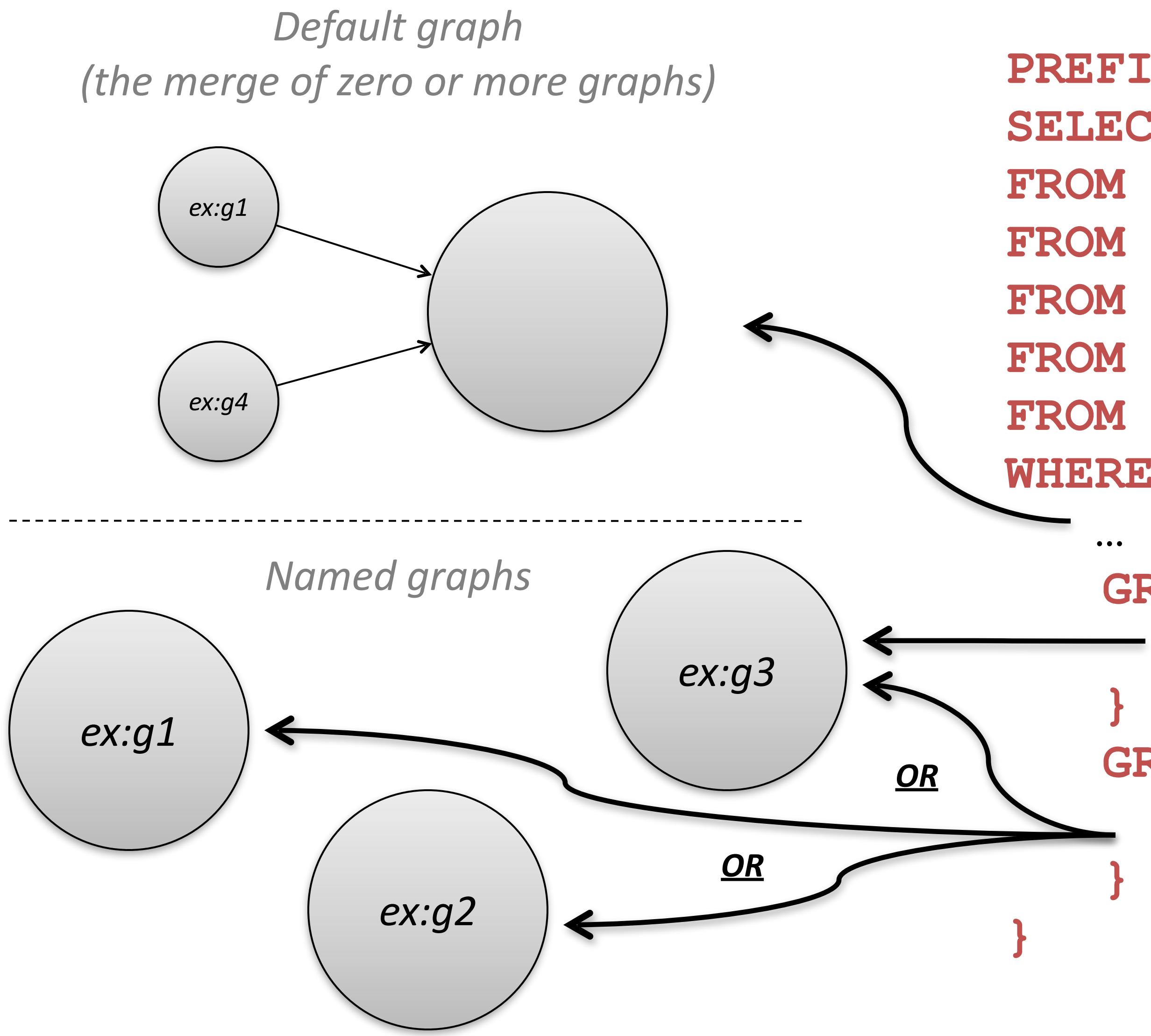
Property Paths *(SPARQL 1.1)*

- Property paths allow triple patterns to match arbitrary-length paths through a graph
- Predicates are combined with regular-expression-like operators:

Construct	Meaning
`path1/path2`	***Forwards path (`path1` followed by `path2`)***
`^path1`	***Backwards path (object to subject)***
`path1|path2`	***Either `path1` or `path2`***
`path1*`	***`path1`, repeated zero or more times***
`path1+`	***`path1`, repeated one or more times***
`path1?`	***`path1`, optionally***
`!uri`	***Any predicate except `uri`***
`!^uri`	***Any backwards (object to subject) predicate except `uri`***

RDF Datasets

A SPARQL queries a *default graph* (normally) and zero or more *named graphs* (when inside a **GRAPH** clause).



```
PREFIX ex: <…>
SELECT …
FROM ex:g1
FROM ex:g4
FROM NAMED ex:g1
FROM NAMED ex:g2
FROM NAMED ex:g3
WHERE {
   … A …
   GRAPH ex:g3 {
      … B …
   }
   GRAPH ?graph {
      … C …
   }
}
```

SPARQL Over HTTP (the SPARQL Protocol)

`http://host.domain.com/sparql/endpoint?`*<parameters>*

where *<parameters>* can include:

`query=`*<encoded query string>*

e.g. `SELECT+*%0DWHERE+{`…

`default-graph-uri=`*<encoded graph URI>*

e.g. `http%3A%2F%2Fexmaple.com%2Ffoo`…

n.b. zero of more occurrences of `default-graph-uri`

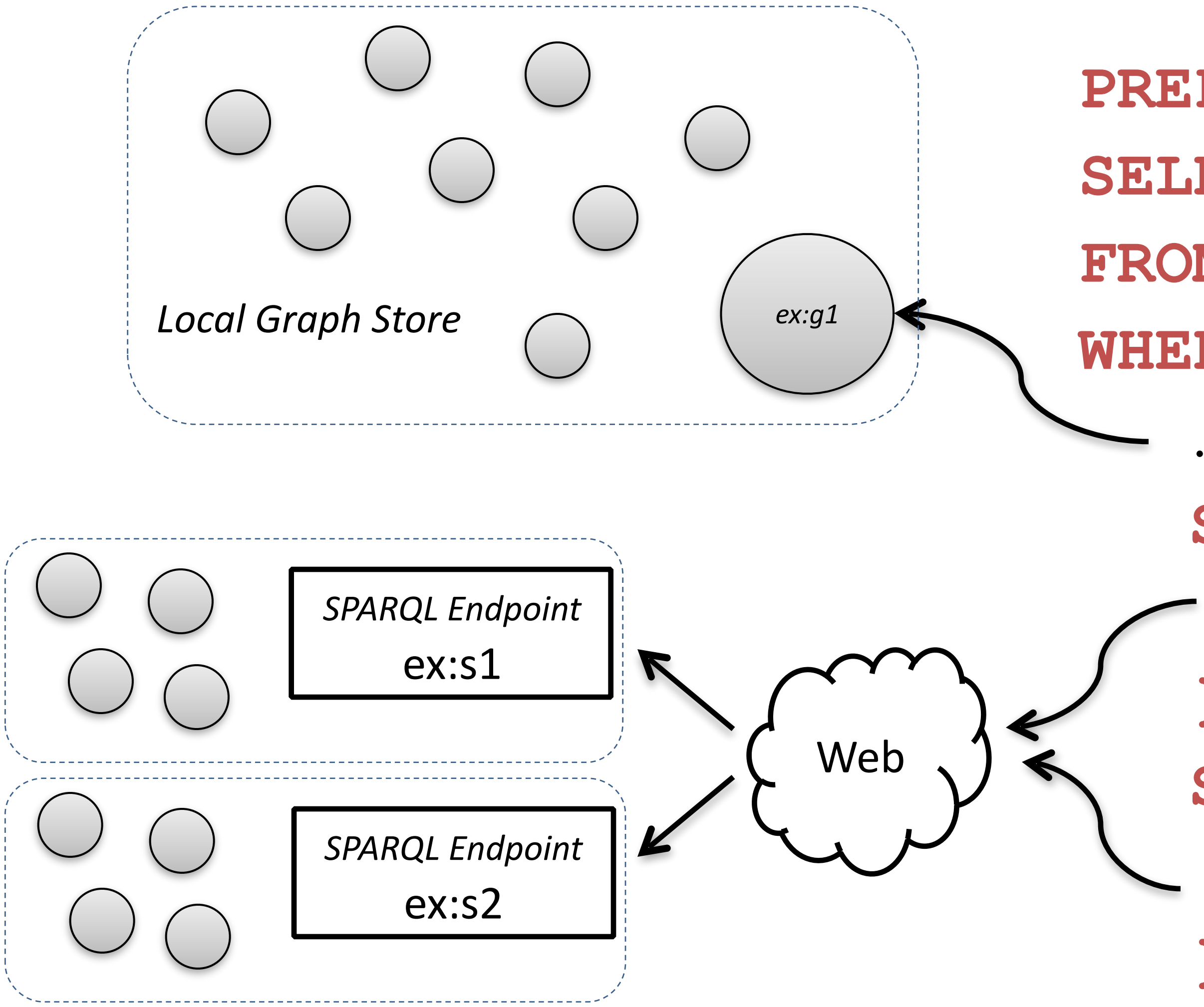
`named-graph-uri=`*<encoded graph URI>*

e.g. `http%3A%2F%2Fexmaple.com%2Fbar`…

n.b. zero of more occurrences of `named-graph-uri`

HTTP `GET` or `POST`. Graphs given in the protocol override graphs given in the query.

Federated Query *(SPARQL 1.1)*



```
PREFIX ex: <…>
SELECT …
FROM ex:g1
WHERE {
   … A …
   SERVICE ex:s1 {
      … B …
   }
   SERVICE ex:s2 {
      … C …
   }
}
```

SPARQL 1.1 Update

SPARQL Update Language Statements
`INSERT DATA { triples }`
`DELETE DATA {triples}`
`[ DELETE { template } ] [ INSERT { template } ] WHERE { pattern }`
`LOAD <uri> [ INTO GRAPH <uri> ]`
`CLEAR GRAPH <uri>`
`CREATE GRAPH <uri>`
`DROP GRAPH <uri>`

[…] denotes optional parts of SPARQL 1.1 Update syntax

Some Public SPARQL Endpoints

Name	URL	What's there?
SPARQLer	*http://sparql.org/sparql.html*	*General-purpose query endpoint for Web-accessible data*
DBPedia	*http://dbpedia.org/sparql*	*Extensive RDF data from Wikipedia*
DBLP	*http://www4.wiwiss.fu-berlin.de/dblp/snorql/*	*Bibliographic data from computer science journals and conferences*
LinkedMDB	*http://data.linkedmdb.org/sparql*	*Films, actors, directors, writers, producers, etc.*
World Factbook	*http://www4.wiwiss.fu-berlin.de/factbook/snorql/*	*Country statistics from the CIA World Factbook*
bio2rdf	*http://bio2rdf.org/sparql*	*Bioinformatics data from around 40 public databases*

SPARQL Resources

- SPARQL Specifications Overview
  - http://www.w3.org/TR/sparql11-overview/
- SPARQL implementations
  - http://esw.w3.org/topic/SparqlImplementations
- SPARQL endpoints
  - http://esw.w3.org/topic/SparqlEndpoints
- SPARQL Frequently Asked Questions
  - http://www.thefigtrees.net/lee/sw/sparql-faq
- Common SPARQL extensions
  - http://esw.w3.org/topic/SPARQL/Extensions